R-4 79-2

BIOLOGICAL EVALUATION

WESTERN SPRUCE BUDWORM
BOISE AND PAYETTE NATIONAL FORESTS
1978

Forest Insect and Disease Management
State and Private Forestry
USDA - Forest Service
Boise, Idaho

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INTRODUCTION

Aerial surveys were flown during July, August, and early September, 1978, over the Boise and Payette National Forests to sketch map areas of budworm defoliation. The categories of damage included light, moderate, and heavy defoliation. These flights included portions of the Idaho Primitive Area that are within the Boise and Payette National Forests (Figure 1). To date the Boise-Payette infestations have remained contiguous and as such they will be treated in this report as one infestation.

HISTORICAL INFORMATION

The western spruce budworm is a native pest which has been recorded in North America since the late 1800's. In the Intermountain Region, the first epidemic was recorded in southern Idaho in 1922. Since that time, budworm populations have built up to epidemic portions and subsided on a somewhat periodic basis. In recent years epidemics were noted in the 1950's, the early 1960's, and again in the 1970's. Historical records show that in the northern Rocky Mountains, epidemics usually last 1 to 5 years with extensions of 6 to 15 years; however, southward in the Intermountain Region, which encompasses the Boise and Payette National Forests, infestations of about 9 years are more the rule. When aerial spray techniques and modern chemicals became available, suppression activities were undertaken in the Intermountain Region. The first large-scale program took place in 1955 when 837,210 acres were aerially sprayed with DDT at the rate of 1 lb. per acre. Other large-scale spray operations followed in 1956, 1957, 1963 and 1964. A large-scale outbreak that was considered for suppression in 1965 was cancelled when unseasonable spring freezes caused severe larval reductions.

In 1954 when wide-scale aerial surveillance programs were begun in the Intermountain Region, western spruce budworm was reported on several Forests. Activity since that time has been observed on an annual basis in the Intermountain Region with infestations ranging from small scale to in excess of 2,000,000 acres in 1964.

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GENERAL INFORMATION

INSECT: Western spruce budworm, Choristoneura occidentalis Freeman.

HOST TREES: Grand fir, Abies grandis (Dougl.) Lindl.
Subalpine fir, Abies lasiocarpa (Hook.) Nutt.
Douglas-fir, Pseudotsuga menziesii var. glauca (Beissn) Franco.
Engelmann spruce, Picea engelmanni Parry.
Western larch, Larix occidentalis Nutt.

LOCATION: Boise National Forest - areas north of High Valley, west and north of Sagehen Reservoir, northward along West Mountain west of Cascade, Idaho - continuing to the northern Boise Forest boundary where the in-infestation joins those on the Payette National Forest. Areas north and east of Cascade, Idaho, along the Warm Lake highway extending northward into the Gold Fork drainage. Areas west, north and northeast of Deadwood Reservoir. A small localized infestation along the Hawley Mountain Ridge road east of Horseshoe Bend, Idaho. Areas east and southeast of Smiths Ferry toward Packer John Mountain and spilling over into the Middle Fork of the Payette River north of Crouch, Idaho.

Payette National Forest - areas west, north, east and southeast of McCall, including the South Fork of the Salmon River drainage on the east. Southward to and contiguous with infestations on the Boise National Forest in the Gold Fork area and scattered locations northward along the Little Salmon River and the east side of Highway 95 toward Riggins, areas on the west side of the Payette Forest boundaried by Horse and Smith Mountain lookouts, Railroad Saddle, and southward to Bear Guard Station in Bear Creek drainage. Areas east of Council, Idaho, running southward to the vicinity of King Hill in the Little Weiser River drainage. These budworm infested areas become contiguous with east slope drainages at the No Business Mountain FAA site running northward along Red Ridge toward Highway 95, west of McCall.

Features of the Area: western spruce budworm defoliation covers landforms that range from heavily roaded to basically inaccessible. The most significantly visible portion of the infestation lies west of Cascade, Idaho, on West Mountain.

The most rugged and semi-remote portion of the infestation encompasses the South Fork of the Salmon River from a point approximately 5 miles north of Warm Lake and extends downstream to the confluence of the South Fork and Main Salmon Rivers. Primitive area portions of the infestation are characterized by steep, highly dissected landforms with wide differences in elevation and mostly inaccessible except by horseback or foot travel.

BIOLOGICAL INFORMATION

The most notable expansions of budworm defoliation on the Boise National Forest in 1978 occurred in the vicinity of Packer John Mountain and westward and northward from Sagehen Reservoir. Budworm defoliation was observed on the Boise National Forest east and southeast of Smiths Ferry and defoliation intensities increased over several thousand acres from light to the moderate and heavy categories during 1978. One of the oldest infestations on the Payette National Forest, Boulder Creek-Brush Mountain area, which has been supporting budworm populations since 1968, declined drastically. Increases in defoliation were noted on the Council Ranger District and heavy defoliation continues southward from McCall into and contiguous with budworm areas on the Boise National Forest along West Mountain. Budworm defoliation in the Paddy Flat-Sloans Point area extended southward across Gold Fork and is now contiguous with defoliated areas on the Boise National Forest approximately 10 air miles north of Cascade, Idaho. Currently, 753,418 acres of conifers are being defoliated by the budworm which is a slight reduction from the over 777,000 observed in 1977.

Aerial Sketch Map Survey

Visual defoliation was aerially sketch mapped during July, August, and early September 1978 (Figure 1). On the Boise National Forest defoliation was categorized as follows: light 33,545 acres; moderate 95,796; heavy 98,674 for a total of 228,015 acres. This is an increase of 95,915 acres over that observed in 1977. On the Payette National Forest defoliation was categorized thusly: light 21,435 acres; moderate 82,041 acres; heavy 205,453 for a total of 308,929. This is a decrease of 45,171 acres since 1977. Decreases occurred primarily in the Boulder Creek-Brush Mountain areas of the New Meadows Ranger District and along the eastern side of the Little Salmon River from New Neadows to Riggins, Idaho. In the Primitive Area portion of the Payette, 84,250 acres of visible defoliation was recorded. As previously noted, one of the oldest and heaviest areas of defoliation occurred in the vicinity of Boulder Creek on the New Meadows Ranger District; however, visible defoliation virtually dropped out of that area in 1978. This indicates a decline in intensity and acres defoliated to the northwest of McCall, Idaho. There was a slight reduction in total acres defoliated along the South Fork of Salmon River; however, infestation intensities generally were classed as heavy with mortality occurring in understory grand fir and top killing in grand fir and Douglas-fir still quite obvious. These infestations have been in progress since 1967, and 1978 marks the first time on the Payette that a downward trend in defoliation has been observed. Both aerial and ground observations indicate that understory grand fir has suffered mortality. Some top killing was also observed in Douglas-fir and grand fir. The more recent infestations north of Sagehen Reservoir on the Boise National Forest increased in intensity from moderate to heavy. Also, infestations spread northward into the Squaw Creek drainage. To date no visible budworm defoliation has been found in larch stands.

Budworm populations usually exist at low levels in the forest, held in check primarily by natural enemies, influences of forest stand conditions, and climatic factors. Periodically, however, these natural controls cannot keep pace with population development and widespread epidemics develop.

Parasite Survey

Two separate parasite projects were conducted during 1978 by personnel from the Boise Field Office and by personnel from the Pacific Southwest Station (PSW) Project 2206. The PSW project was completed in conjunction with a field test of chemical insecticides near Cascade, Idaho. Boise Field Office personnel collected larvae and pupae from 19 locations on the Cascade, McCall and New Meadows Ranger Districts. Parasites were laboratory reared from field collected specimens. Results of the two parasite studies are as follows:

R-4, FI&DM Parasite Survey

# of WSBW Reared	# of Wasp Parasites	# of Fly Parasites	Total Emerged Parasites	Percent Parasitism
1,063	36	174	210	20

PSW Parasite Survey

13,333	1,900	348	2,515	19

Parasite specimens identified by the U.S. National Museum from FI&DM budworm parasite surveys in 1976 and 1977 have included:

Hymenoptera

Braconidae, *Apanteles fumiferanae* Vier.
Pteromalidae, *Mesopolobus veriditer* (Norton)

Ichneumonidae, *Phaeogenes hariolus* (Cr.)
Glypta fumiferanae (Vier.)
Itoplectis quadricingulata (Prov.)
Gelis tenellus (Say)

Diptera

Tachinidae, *Madremyia saundersii* (Will.)
Aplomya caesar (Ald.)
Phryxe pecosensis Ths.
Nemorilla sp.
Pseudoperichaeta sp.
Actia sp.

The two 1978 studies showed parasitism rates approaching 20 percent. Previously, parasitism rates of 13 and 10 percent were recorded respectively for 1977 and 1976. Highly effective biological control can be achieved when parasitism reaches 50 to 70 percent in budworm outbreaks. To date, parasitism levels have not approached those figures. As a matter of comparison, 70 to 90 percent parasitism has been recorded in pine butterfly and tussock moth populations with significant biological control realized.

Egg Mass Survey

In 1977, 12 biological units, as well as 6 entomological blocks, were established on the Boise and Payette National Forests. During the 1977 field season, crews sampled from 10 of these units to obtain 1978 defoliation prediction data. During the 1978 field season, the 6 entomological blocks were the primary sampling locations with additional sample plots outside these blocks.

Twenty-nine egg mass evaluation plots were established on the Boise National Forest and 123 plots on the Payette. Egg mass counts were made by collecting two 70-centimeter branches from opposite quadrants of three codominant Douglas-fir or grand fir on each plot. Branches were carefully removed with telescopic pruners, labeled, placed in individual cloth sacks and transported to the laboratory in McCall for examination.

Predictions are calculated on the basis of egg masses per cluster (3 trees). Currently, the Methods Application Group, Forest Insect and Disease Management, Davis, California, is developing a model to predict defoliation. However, most are from Douglas-fir and do not predict well for grand fir. As a result, the egg mass per cluster method was employed for predictions shown in the following table:

		Predicted Defoliation - 1979	
Number	Name	Average Defoliation	Overall Defoliation
1	McCall East	41-55 %	Moderate - Heavy
2	West Mountain	41-55 %	Moderate - Heavy
3	New Meadows	41-55 %	Moderate - Heavy
4	Boulder	26-40 %	Light - Moderate
5	Council	41-55 %	Moderate - Heavy
6	Krassel	26-40 %	Light - Moderate

DISCUSSION

Decreases in budworm defoliation observed during aerial sketch map surveys on the Payette National Forest in 1978 amounted to slightly more than 45,000 acres. Conversely, increase in defoliation detected on the Boise National Forest was nearly 96,000 acres. Surveys flown this year in the Idaho Primitive Area indicate 132,224 and 84,250 acres of defoliation respectively for the Boise and Payette. No attempt was made to classify primitive area defoliation by intensity. However, an estimated 90 percent of the area could be classed as moderately to heavily defoliated.

In 1979, Forest Insect and Disease Management personnel will again conduct stand impact, parasite, and egg mass surveys and aerial detection surveys to gather information on western spruce budworm activity throughout southwestern Idaho. These activities will provide land managers with information in order to make decisions concerning the necessity of initiating future suppression programs. In 1978, six entomological units were identified for possible suppression consideration. These included McCall East, West Mountain, New Meadows, Boulder, Council, and Krassel. In early 1979 additions to these entomological units will be made to include newly defoliated areas.

In reviewing available data, it appears western spruce budworm has the potential to increase in extent and intensity of defoliation on the Boise and Payette National Forests. Very few biological controls are effective against the spruce budworm. However, on occasion, severe climatic changes during the early larval stages can cause drastic population reductions. Such was the case on the Salmon National Forest in 1965.

Both the 1977 and 1978 data indicate heaviest damage occurs in grand fir habitat types. Specific habitat types in which grand fir was most damaged were grand fir/western gold thread and grand fir/Queen cup bead lilly. Two other grand fir habitat types which showed considerable budworm activity were grand fir/twin flower and grand fir/mountain maple. In the dryer grand fir/blue huckleberry habitat type only moderate levels of activity were observed.

Several areas of investigation are being pursued in order to provide land managers with data that will be useful in management decision-making. Some of these activities include: (1) a refined assessment of incidence and degree of damage incurred by affected stands (Beveridge, Ollieu and Bousfield, 1979), (2) egg mass sampling to provide improved predictive data for forecasting budworm activity, (3) parasite rearing of larval and pupal populations to assess parasitism, and (4) annual aerial detection sketch mapping to keep abreast of budworm defoliation and damage intensity. Even though over 45,000 acres defoliated in 1977 were unaffected in 1978 on the Payette Forest, budworm populations can still be classed as epidemic over large portions of the Boise and Payette National Forests (Knopf, Valcarce and Beveridge, 1978).

REFERENCES

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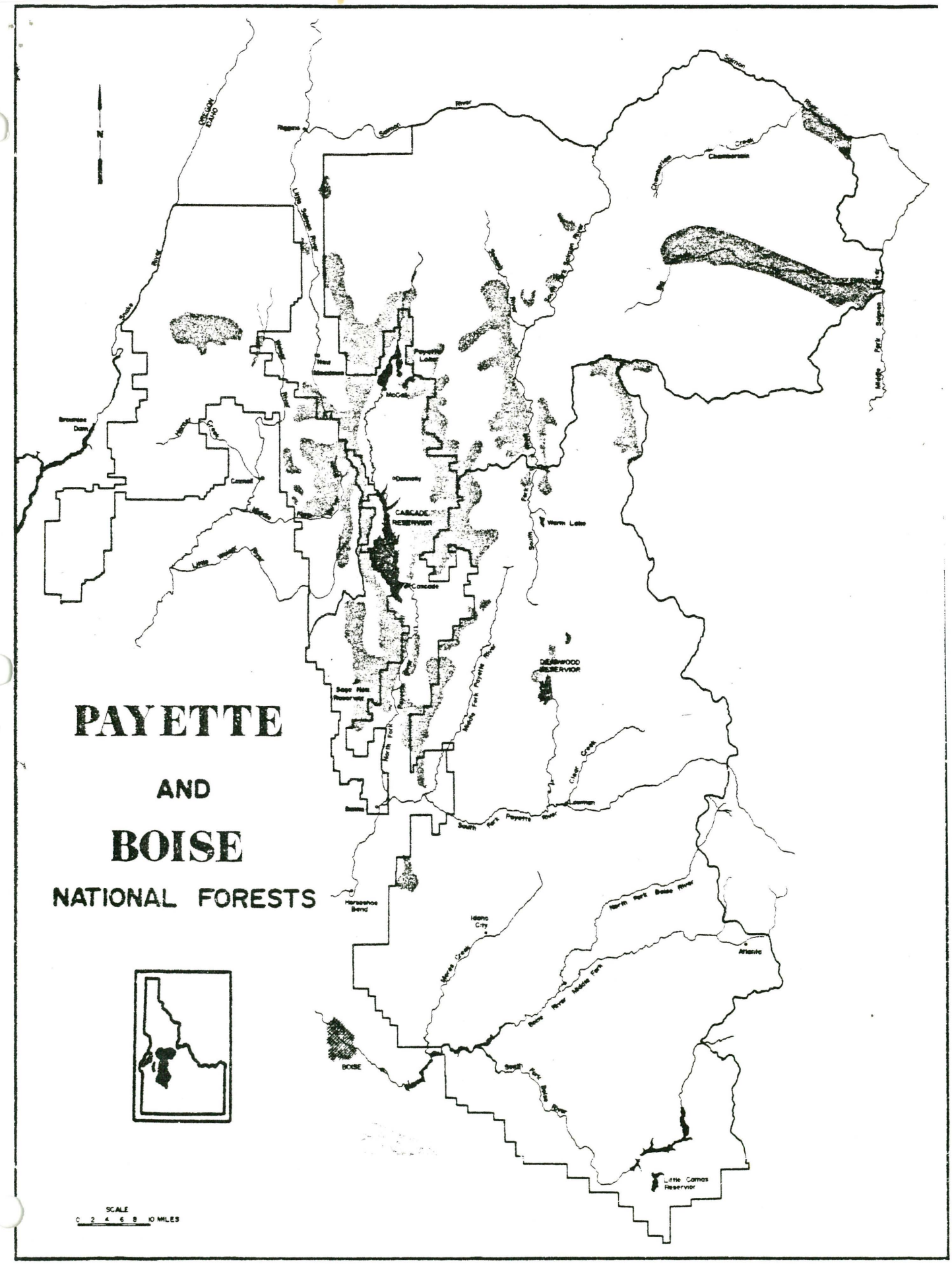

Figure 1. Area of defoliation by western spruce budworm, Boise and Payette National Forests and intermingled federal, state and private lands--1978.